

Accuracy Characteristics for ZDC Risk Reduction Scenario Hours 2000-2200

1 Introduction

This document contains scenario characteristics for hours 2000 to 2200 GMT recorded on October 11, 2000 at Washington ARTCC (ZDC). Characteristics to be provided are general statistics determined from the scenario on airspace characteristics, aircraft to aircraft and aircraft to airspace encounters, general air traffic, aircraft, and flight plan adherence. Definitions of the provided scenario characteristics are provided in Reference[1].

2 Reference

[1] Paglione,M., Oaks,R., Ryan,Dr. H., Summerill,J.S., (Final, January 2000), *Description of Accuracy Scenarios for the Acceptance Testing of the User Request Evaluation Tool (URET) / Core Capability Limited Deployment (CCLD)*, FAA William J. Hughes Technical Center / ACT-250, Atlantic City, New Jersey.

NOTE – Section numbers in this document do not map to those of the reference document.

3 Center Airspace

This section corresponds to Section 3.1 of Reference[1]. The below data corresponds to the ZDC Center using the October 11, 2000 ACES chart cycle. Information provided in Table 1 was gathered from running URET PRE and local knowledge.

Table 1: Center Airspace Characteristics

Metric	Definitions	Count
Airports	From URET DU Adaptation List	TBD
Sectors	From URET DU Adaptation List	TBD
SAA	Special Activities Airspace	TBD
APDIA	Automated Problem Detection Inhibited Area	TBD
SID	Standard Instrument Departure	TBD
STAR	Standard Arrival Route	TBD
PAR	Preferential Arrival Route	TBD
PDR	Preferential Departure Route	TBD
PDAR	Preferential Departure Arrival Route	TBD

4 Aircraft Encounter Distributions

The statistics collected in this section characterize aircraft to aircraft encounters. The encounter counts are partitioned by selected minimum horizontal separation intervals, a count of encounters partitioned by standard flight levels, and by vertical phase of flight and aircraft encounter angle. This section corresponds to Section 3.2.1 in Reference[1].

4.1 Count Partitioned by Minimum Horizontal Separation

This section corresponds to Section 3.2.1.1 in Reference[1].

Table 2: Count of Current Plan Aircraft Encounters

Min. Horz. Separation (nm)	Without Adherence	13 Minutes Adherence
$0 \leq d < 5$	43	16
$5 \leq d < 10$	45	16
$10 \leq d < 15$	88	35
$15 \leq d < 23$	187	71
$23 \leq d < 30$	172	77
Total	535	215

Table 3: Count of Trial Plan Aircraft Encounters

Min. Horz. Separation (nm)	Without Adherence	20 minutes Adherence
$0 \leq d < 5$	43	15
$5 \leq d < 10$	45	15
$10 \leq d < 15$	88	34
$15 \leq d < 24$	220	80
$24 \leq d < 30$	139	58
Total	535	202

4.2 Count Partitioned by Altitude for Standard Separation Intervals

This section corresponds to Section 3.2.1.2 of Reference[1].

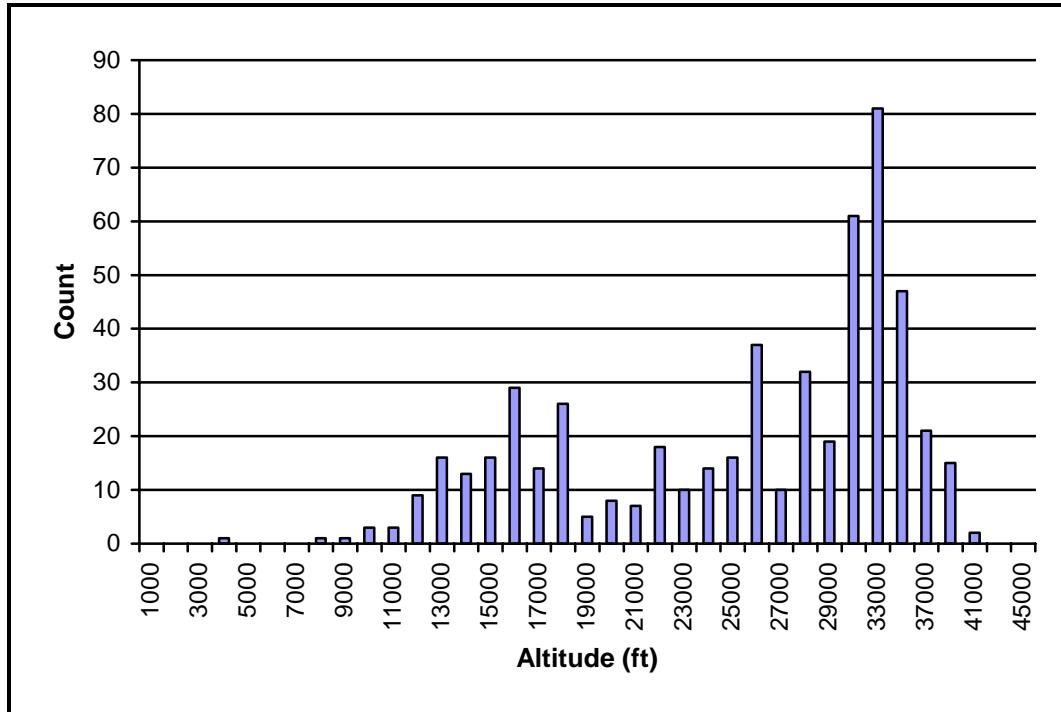


Figure 1: Aircraft to Aircraft Encounters by Altitude

4.3 Count Partitioned by Vertical Phase of Flight and Encounter Angle

This section corresponds to Section 3.2.1.3 of Reference[1].

Table 4: Count of Aircraft Encounters Partitioned by Phase of Flight and Encounter Angle

Vertical Phase	Encounter Angles (deg)				Total
	[0, 45)	[45, 90)	[90, 135)	[135, 180]	
Cruise-Cruise	28	3	3	20	54
Descend-Descend	57	5	3	7	72
Climb-Climb	34	0	1	2	37
Cruise-Climb	78	9	10	26	123
Cruise-Descend	98	24	12	61	195
Climb-Descend	17	13	2	8	40
Unknown	11	1	0	2	14
Total	323	55	31	126	535

5 Airspace Encounter Distributions

This section provides statistics on aircraft to airspace encounters. Three areas considered are counts partitioned by selected minimum horizontal separation intervals, an encounter count partitioned by standard flight levels, and a count partitioned by vertical phase of flight and airspace encounter angle. Additionally, vertical phase of flight count is separated into top, bottom and side airspace encounters and for encounters with unknown encounter angles. The section corresponds to Section 3.2.2 of Reference[1].

5.1 Count Partitioned by Minimum Horizontal Separation

The section corresponds to Section 3.2.2.1 of Reference[1].

Table 5: Count of Current Plan Airspace Encounters by Horizontal Separation

Min. Horz. Separation (nm)	Without Adherence	13 minutes Adherence
Conflicts ¹	79	51
$d = 0^2$	5	3
$0 < d < 7$	228	144
$7 \leq d < 9$	53	29
$9 \leq d < 11$	80	49
$11 \leq d < 16$	145	94
$16 \leq d < 30$	462	305
Total	1052	675

Table 6: Count of Trial Plan Airspace Encounters by Horizontal Separation

Min. Horz. Separation (nm)	Without Adherence	20 minutes Adherence
Conflicts ³	79	48
$d = 0^4$	5	3
$0 < d < 8$	249	150
$8 \leq d < 11$	112	70
$11 \leq d < 13$	62	32
$13 \leq d < 19$	189	139
$19 \leq d < 30$	356	212
Total	1052	654

¹ This count includes encounters that are conflicts. By definition the minimum horizontal separation is zero and the track point actually penetrates the airspace.

² This count includes encounters without valid airspace penetrations, which occurs under two cases: a short duration penetration or an encounter on the actual buffered boundary of the airspace which does not penetrate.

³ This count includes encounters that are conflicts. By definition the minimum horizontal separation is zero and the track point actually penetrates the airspace.

⁴ This count includes encounters without valid airspace penetrations, which occurs under two cases: a short duration penetration or an encounter on the actual buffered boundary of the airspace which does not penetrate.

5.2 Count Partitioned by Altitude

This section corresponds to Section 3.2.2.2 of Reference[1].

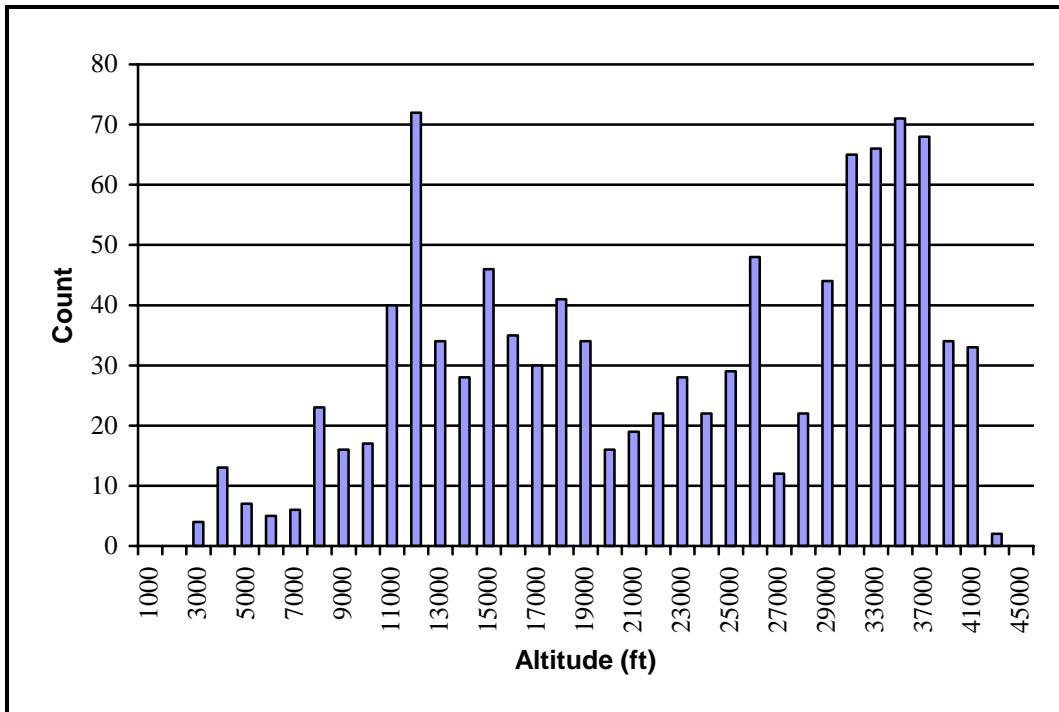


Figure 2: Airspace to Airspace Encounters by Altitude

5.3 Count by Vertical Phase of Flight and Encounter Angle

This section corresponds to Section 3.2.2.3 in Reference[1].

Table 7: Count of Airspace Encounters by Angle and Vertical Phase of Flight for Side Conflicts

Vertical Phase	Encounter Angles (deg)			Total
	[0, 30)	[30, 60)	[60, 90)	
Climb	3	4	2	9
Cruise	17	14	11	42
Descend	3	3	3	9
Total	23	21	16	60

Table 8: Count of Airspace Encounters by Angle and Vertical Phase of Flight for Top and Bottom Conflicts

Vertical Phase	Encounter Angles (deg)			Total
	[0, 30)	[30, 60)	[60, 90)	
Climb	3	0	0	3
Cruise	0	0	0	0
Descend	5	0	0	5
Total	8	0	0	8

Table 9: Count of Airspace Encounters by Vertical Phase of Flight with Unknown Angles

Vertical Phase	Count
Climb	5
Cruise	5
Descend	1
Total	11

6 Air Traffic Distributions

This section provides metrics that characterize the air traffic. The metrics are flight density partitioned by standard flight levels, flight type and sector penetration, statistics on the number of active flights, ground speed statistics, counts of interim altitude and amendment messages, and air traffic maneuvers by altitude and phase of flight. This section corresponds to Section 3.3 of Reference[1].

6.1 Air Traffic Density

This section corresponds to section 3.3.1 of Reference[1]. Detailed statistics on aircraft encounters are provided in Appendix A.

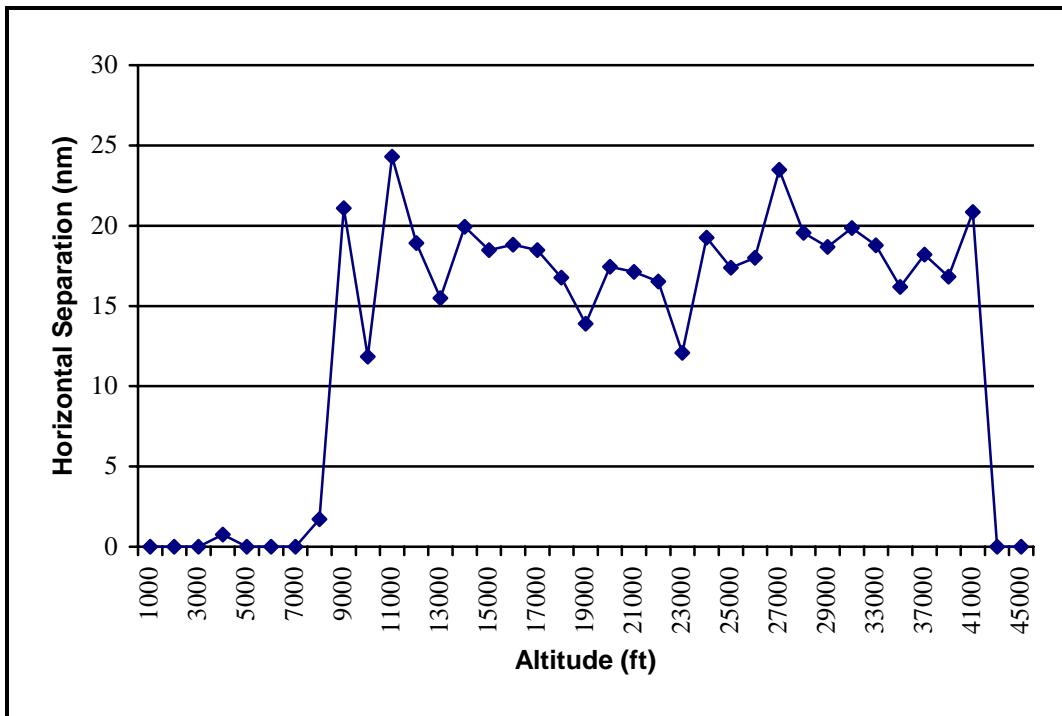


Figure 3: Average Horizontal Separation by Altitude for All Hours

6.2 Active Flights

This section corresponds to section 3.3.2 of Reference[1].

Table 10: Statistics on Active Flights per Minute Increment

Count Average	Standard Deviation	Maximum Count	Minimum Count
73.992	90.432	233	0

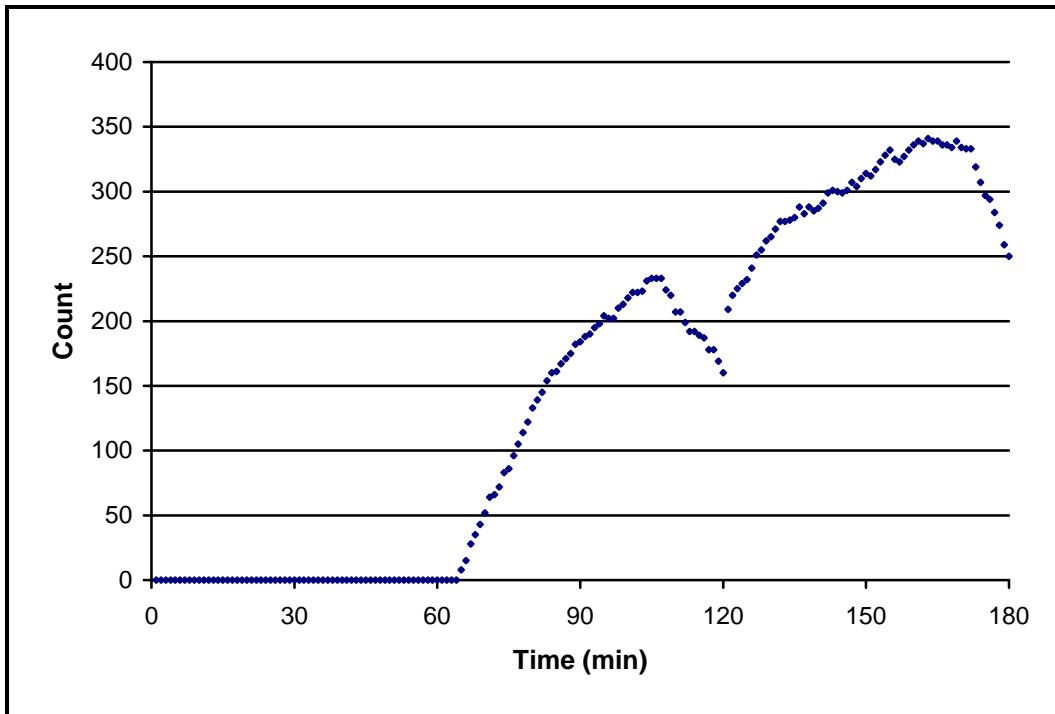


Figure 4: Count of Active Flights per Minute Increment

6.3 Flight Type and Sector Penetration

This section corresponds to Section 3.3.3 of Reference[1].

Table 11: Statistics on Sector Time, Center Time and Sector Penetration by Flight Type

Metric	Arrivals	Departures	Internals	Overflights	All Flights
Average Number of Sectors Penetrated	2.174	2.329	2.303	2.643	2.291
Average Time in Center (sec)	1161.468	1401.571	1197.368	1743.214	1266.565
Average Time in Sector (sec)	524.852	595.521	509.514	653.378	543.942
Percentage by Flight Type	30.200	19.400	42.100	7.800	100.000

6.4 Ground Speed

This section corresponds to Section 3.3.4 of Reference[1]. Detailed statistics on aircraft ground speed are provided in Appendix B.

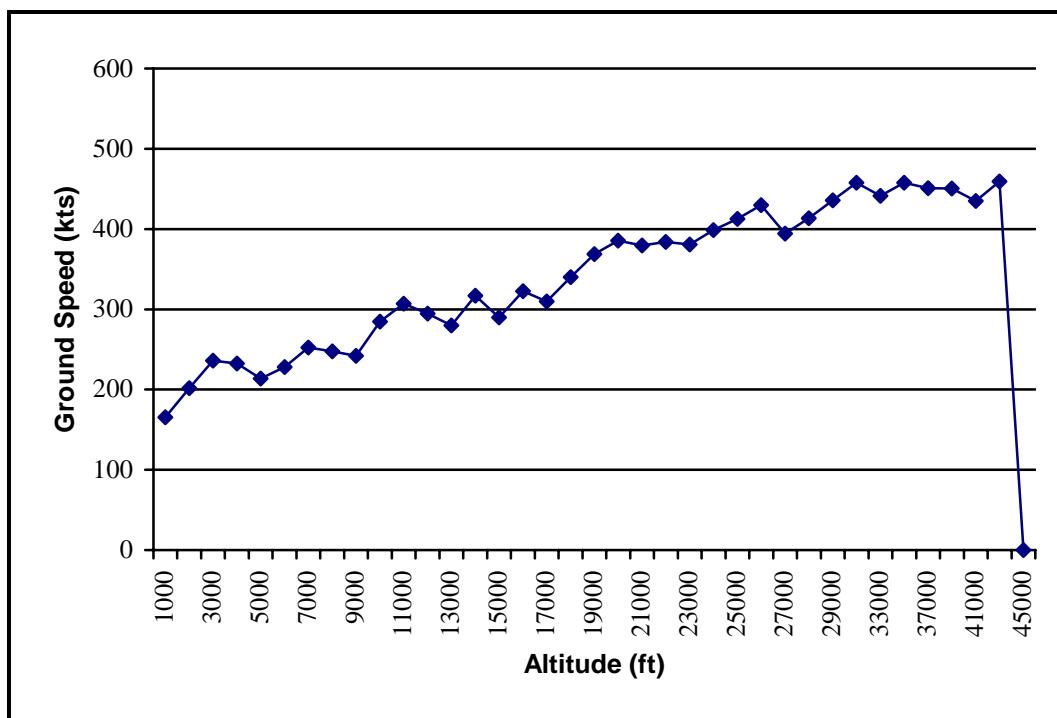


Figure 5: Average Ground Speed by Altitude for All Hours

6.5 Center to APD Ratio

This section corresponds to Section 3.3.5 of Reference[1].

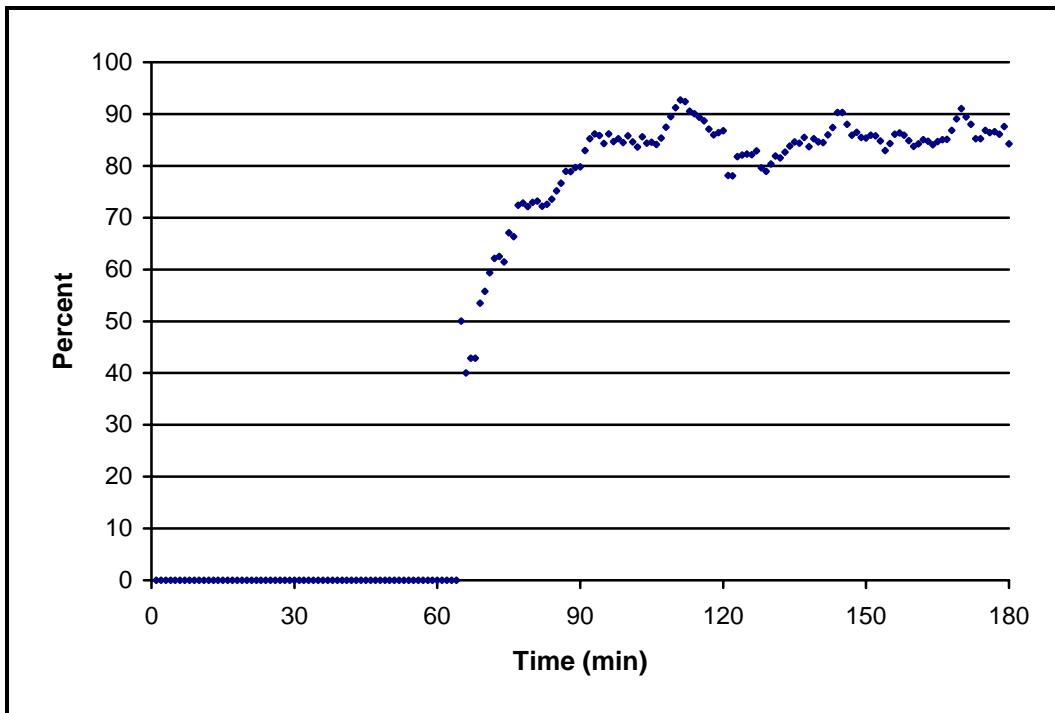


Figure 6: Percentage of Track Points in Center to APD Zone per Minute Increment

6.6 Interim Altitude Messages

This section corresponds to Section 3.3.6 of Reference[1].

Table 12: Statistics on Interim Altitude Messages⁵

Flight Count	Average	Standard Deviation	Maximum Count	Minimum Count
158	2.563	0.825	4	1

6.7 Amendment Messages

This section corresponds to Section 3.3.7 of Reference[1]

Table 13: Statistics on Amendment Messages per Flight⁶

Flight Count	Average	Standard Deviation	Maximum Count	Minimum Count
227	2.767	1.875	11	1

⁵ Statistics on flights with interim altitude messages only

⁶ Statistics on flights with flight plan amendments only

6.8 Air Traffic Maneuvers

This section corresponds to Section 3.3.8 of Reference[1]. Detailed statistics on air traffic maneuvers are provided in Appendix C.

Table 14: Total Track Report Maneuver Count by Vertical and Horizontal Phase of Flight

Vertical Phase	Horizontal Phase of Flight		Total
	STR	TURN	
ASC	1558	472	2030
DES	2749	488	3237
LEV	848	450	1298
Total	5155	1410	6565

Table 15: Percent breakdown of Flight Tracks by Vertical and Horizontal Phase

Vertical Phase	Horizontal Phase of Flight		Margin (%)
	STR (%)	TURN (%)	
ASC	23.732	7.190	30.922
DES	41.874	7.433	49.307
LEV	12.917	6.855	19.772
Margin (%)	78.522	21.478	100.000

7 Aircraft Distributions

This sections provides the metrics used to characterize the aircraft provided in the scenario. The selected metrics are aircraft type, model, navigational equipment, and the air carriers operating in the airspace. The section corresponds to Section 3.4 of Reference[1].

7.1 Aircraft Type

This section corresponds to Section 3.4.1 of Reference[1].

Table 16: Count by Aircraft Type

Aircraft Type	Count	Percentage of Total
J	289	77.480
P	9	2.413
T	70	18.767
Unknown	5	1.340
Total	373	100.000

7.2 Aircraft Models

This section corresponds to Section 3.4.2 of Reference[1]. A full listing and count of aircraft models is provided in Appendix D.

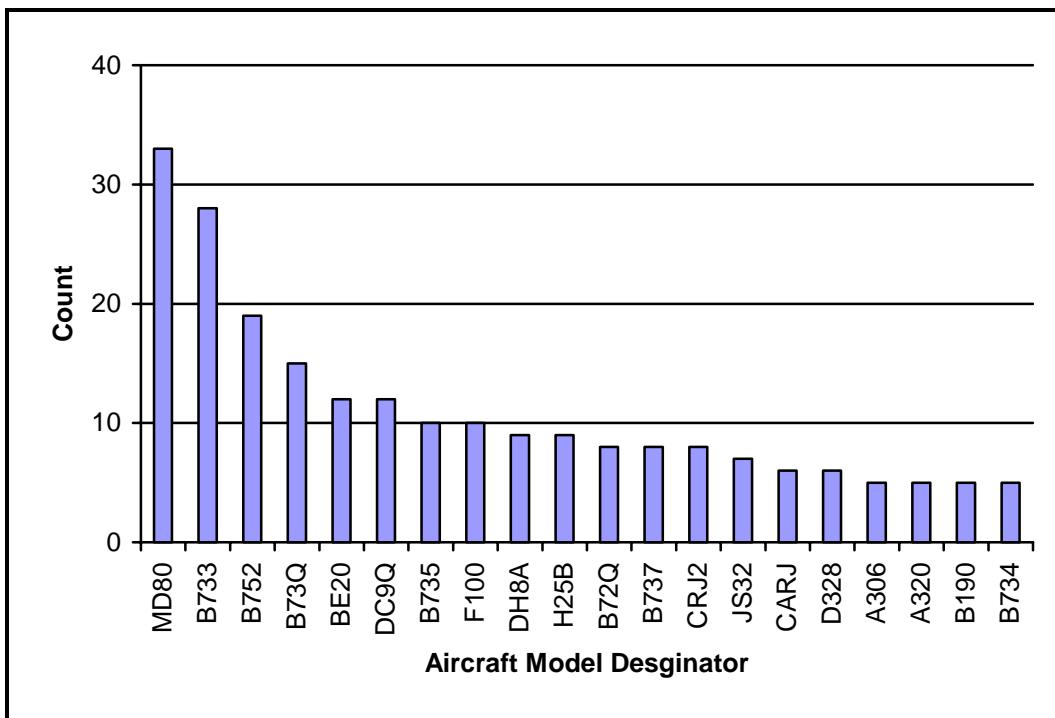


Figure 7: Count of Top Twenty Aircraft Models

7.3 Navigational Equipage

This section corresponds to Section 3.4.3 of Reference[1].

Table 17: Count by Aircraft Navigational Equipage Type

Nav. Equip. Designator	Count	Percentage of total
A	76	20.375
F	65	17.426
I	64	17.158
E	62	16.622
G	62	16.622
R	26	6.971
Q	11	2.949
W	4	1.072
U	3	0.804
Total	373	100.000

7.4 Carrier Distribution

This section corresponds to Section 3.4.4 of Reference[1].

Table 18: Count by Carrier Type

Category	Count	Percentage of Total
Commercial	271	72.654
General Aviation	76	20.375
Other ⁷	26	6.971
Total	373	100.000

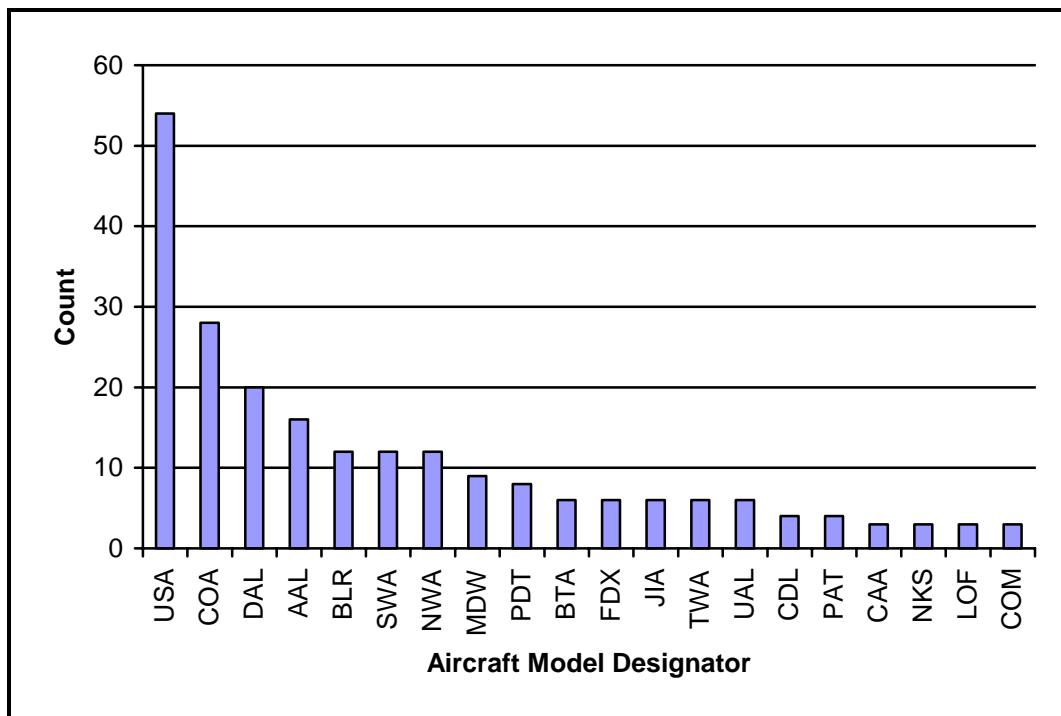


Figure 8: Count by Top Twenty Air Carriers

⁷ Includes military and aircraft with unrecognized designators

8 Flight Plan Adherence

This section provides statistics on lateral and vertical flight plan adherence and corresponds to Section 3.5 of Reference[1].

8.1 Lateral Flight Plan Adherence

This section corresponds to Section 3.5.1 of Reference[1].

Table 19: Statistics on Lateral Flight Plan Adherence by Altitude⁸

Upper Altitude (ft)	Flight Count	Max. Dist. Out (nm)	Min. Dist. Out (nm)	Average Dist. Out (nm)	Standard Dev.(nm)
10000	13	44	11	22.852	9.979
18000	12	45	13	21.020	7.285
33000	28	60	13	29.261	10.345
45000	15	52	19	28.132	8.981
Total	68				

8.2 Vertical Flight Plan Adherence

This section corresponds to Section 3.5.2 of Reference[1].

Table 20: Statistics on Vertical Flight Plan Adherence by Altitude⁹

Upper Altitude (ft)	Flight Count	Max. Dist. Out (ft)	Min. Dist. Out (ft)	Average Dist. Out (ft)	Standard Dev.(ft)
29000	176	33934	334	4446.047	3529.018
45000	62	25000	1800	5349.833	4130.637
Total	238				

⁸ Statistics determined on tracks out of lateral adherence only.

⁹ Statistics were determined on tracks out of vertical adherence only.

Appendix A: Supplement to Section 6.1 - Aircraft Traffic Density

Table 21: Statistics on Aircraft Encounters by Altitude Interval for All Hours

Upper Altitude (ft)	Aircraft Count	Avg. Horz. Sep.(nm)	Standard Dev.(nm)
1000	0	0.000	0.000
2000	0	0.000	0.000
3000	0	0.000	0.000
4000	1	0.762	0.000
5000	0	0.000	0.000
6000	0	0.000	0.000
7000	0	0.000	0.000
8000	1	1.722	0.000
9000	1	21.091	0.000
10000	3	11.833	1.590
11000	3	24.299	5.207
12000	9	18.911	5.854
13000	16	15.491	6.828
14000	13	19.928	6.495
15000	16	18.487	6.487
16000	29	18.823	6.745
17000	14	18.477	5.020
18000	26	16.758	7.562
19000	5	13.892	8.291
20000	8	17.432	7.540
21000	7	17.121	9.238
22000	18	16.528	8.145
23000	10	12.073	5.426
24000	14	19.258	7.958
25000	16	17.390	7.961
26000	37	17.999	8.134
27000	10	23.472	4.607
28000	32	19.564	7.361
29000	19	18.684	7.647
31000	61	19.848	7.577
33000	81	18.785	7.317
35000	47	16.181	8.878
37000	21	18.193	7.112
39000	15	16.822	6.919
41000	2	20.853	3.212
43000	0	0.000	0.000
45000	0	0.000	0.000
Total	535		

Appendix B: Supplement to Section 6.4 - Aircraft Ground Speed

Table 22: Statistics on Ground Speed by Altitude for All Hours

Upper Altitude (ft)	Distinct Aircraft	Average Speed (kts)	Standard Dev.(kts)
1000	4	165.318	23.220
2000	14	201.853	34.262
3000	35	235.868	38.432
4000	60	232.270	45.818
5000	75	213.858	55.173
6000	100	227.855	54.951
7000	113	252.214	42.630
8000	126	247.476	46.745
9000	138	241.950	55.419
10000	148	284.809	59.035
11000	166	306.935	62.762
12000	183	294.551	75.583
13000	184	279.718	71.476
14000	175	316.961	70.004
15000	176	289.900	80.365
16000	171	322.595	69.834
17000	166	309.703	72.923
18000	164	340.187	67.677
19000	157	368.846	68.294
20000	157	385.622	59.955
21000	158	379.573	63.822
22000	157	383.965	81.872
23000	155	380.565	80.607
24000	149	398.780	54.416
25000	145	412.560	51.076
26000	143	429.772	60.592
27000	145	394.261	83.502
28000	143	413.485	72.015
29000	145	435.767	29.116
31000	138	457.816	27.520
33000	117	441.518	24.029
35000	80	457.789	24.680
37000	52	451.075	21.913
39000	31	450.569	19.573
41000	21	435.021	31.294
43000	6	459.086	17.060
45000	0	0.000	0.000

Appendix C: Supplement to Section 6.8 - Air Traffic Maneuvers

Table 23: Count of Maneuvers by Altitude, Vertical and Horizontal Phase of Flight

Upper Altitude (ft)	Vertical Phase	Horizontal Phase of Flight	
		STR	TURN
1000	ASC	1	0
	DES	1	1
	LEV	1	3
2000	ASC	3	2
	DES	1	1
	LEV	7	10
3000	ASC	6	5
	DES	10	6
	LEV	16	17
4000	ASC	6	8
	DES	21	20
	LEV	24	18
5000	ASC	11	6
	DES	19	24
	LEV	37	21
6000	ASC	27	25
	DES	29	25
	LEV	55	26
7000	ASC	13	5
	DES	38	18
	LEV	70	21
8000	ASC	22	17
	DES	39	14
	LEV	77	23
9000	ASC	23	10
	DES	38	21
	LEV	90	31
10000	ASC	25	11
	DES	42	16
	LEV	97	29
11000	ASC	39	16
	DES	59	19
	LEV	116	34
12000	ASC	30	14
	DES	65	30
	LEV	121	14

13000	ASC	18	10
	DES	62	29
	LEV	125	16
14000	ASC	24	12
	DES	58	18
	LEV	121	13
15000	ASC	37	13
	DES	63	17
	LEV	125	19
16000	ASC	28	14
	DES	59	14
	LEV	117	9
17000	ASC	23	13
	DES	58	14
	LEV	118	9
18000	ASC	13	9
	DES	59	20
	LEV	113	16
19000	ASC	11	1
	DES	56	21
	LEV	109	10
20000	ASC	9	4
	DES	60	16
	LEV	109	11
21000	ASC	19	7
	DES	62	13
	LEV	103	13
22000	ASC	28	11
	DES	61	12
	LEV	109	17
23000	ASC	23	9
	DES	59	9
	LEV	105	11
24000	ASC	28	12
	DES	58	11
	LEV	104	14
25000	ASC	32	7
	DES	58	12
	LEV	96	9
26000	ASC	28	11
	DES	57	9

	LEV	96	11
27000	ASC	20	13
	DES	56	8
	LEV	95	13
28000	ASC	28	13
	DES	59	4
	LEV	90	6
29000	ASC	46	22
	DES	59	10
	LEV	88	8
31000	ASC	52	31
	DES	62	16
	LEV	76	20
33000	ASC	54	37
	DES	44	8
	LEV	66	7
35000	ASC	46	29
	DES	38	6
	LEV	33	4
37000	ASC	30	25
	DES	19	3
	LEV	23	3
39000	ASC	24	14
	DES	18	7
	LEV	9	1
41000	ASC	15	10
	DES	7	0
	LEV	7	0
43000	ASC	6	4
	DES	4	0
	LEV	1	1
45000	ASC	0	0
	DES	0	0
	LEV	0	0

Appendix D: Supplement to Section 7.2 - Aircraft Models

Table 24: Count and Percentage of Aircraft by Model Type

Model Type	Aircraft Count	Percent of Total
MD80	33	8.847
B733	28	7.507
B752	19	5.094
B73Q	15	4.021
BE20	12	3.217
DC9Q	12	3.217
B735	10	2.681
F100	10	2.681
DH8A	9	2.413
H25B	9	2.413
B72Q	8	2.145
B737	8	2.145
CRJ2	8	2.145
JS32	7	1.877
CARJ	6	1.609
D328	6	1.609
A306	5	1.340
A320	5	1.340
B190	5	1.340
B734	5	1.340
B772	5	1.340
BE40	5	1.340
E145	5	1.340
A319	4	1.072
BE9L	4	1.072
C560	4	1.072
F15	4	1.072
GLF3	4	1.072
JS41	4	1.072
LJ35	4	1.072
LJ60	4	1.072
SF34	4	1.072
B350	3	0.804
B738	3	0.804
B763	3	0.804
C550	3	0.804
CRJ1	3	0.804

F16	3	0.804
F2TH	3	0.804
GLF4	3	0.804
LJ31	3	0.804
LJ55	3	0.804
ASTR	2	0.536
B722	2	0.536
B762	2	0.536
C130	2	0.536
C17	2	0.536
C650	2	0.536
CL60	2	0.536
DC10	2	0.536
DH8B	2	0.536
LJ25	2	0.536
MD11	2	0.536
PA31	2	0.536
SBR1	2	0.536
SW4	2	0.536
WW24	2	0.536
n/a	2	0.536
A330	1	0.268
A340	1	0.268
AT43	1	0.268
B712	1	0.268
B742	1	0.268
B767	1	0.268
BE10	1	0.268
BE30	1	0.268
BE35	1	0.268
BE3B	1	0.268
BE58	1	0.268
C141	1	0.268
C208	1	0.268
C310	1	0.268
C5	1	0.268
C525	1	0.268
C750	1	0.268
CL64	1	0.268
DC9	1	0.268
DH8C	1	0.268
E120	1	0.268

E135	1	0.268
E6	1	0.268
F28	1	0.268
FA10	1	0.268
FA20	1	0.268
FA50	1	0.268
G2	1	0.268
GLF2	1	0.268
HS25	1	0.268
M20P	1	0.268
MU30	1	0.268
P3	1	0.268
PA32	1	0.268
PA34	1	0.268
PA38	1	0.268
PASE	1	0.268
PAY1	1	0.268
PAY2	1	0.268
STAR	1	0.268
Total	373	100.000